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B60R 1/02

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INT CL[7] **B60R 1/00 1/02**
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(54) Abstract Title
Articulated vehicle with rear view video camera

(57) An articulated vehicle with a rear view video camera comprises a forward tractor unit (102) and a rearward trailer unit (103), the tractor unit (102) and trailer unit (103) being coupled to each other at an articulation coupling (104), wherein the vehicle includes: articulation measurement means that provides a measure of the articulation angle (10) of the units 102,103); at least one video camera (32,33,42,43) with a rearward directed field of view (37,38,47,48); video display means (50) visible to the driver for displaying images (91,92,93,94) from the video camera (32,33,42,43); and actuation means for moving the camera field of view (37,38,47,48) according to the measured articulation angle (10) so that a desired field of view (32,33,42,43) past the trailer unit (103) is displayed to the driver on the display means (50) as the articulation of the vehicle changes. The trailer may carry a video camera 51. The angle of articulation is measured by an infrared beam or an ultrasonic beam.

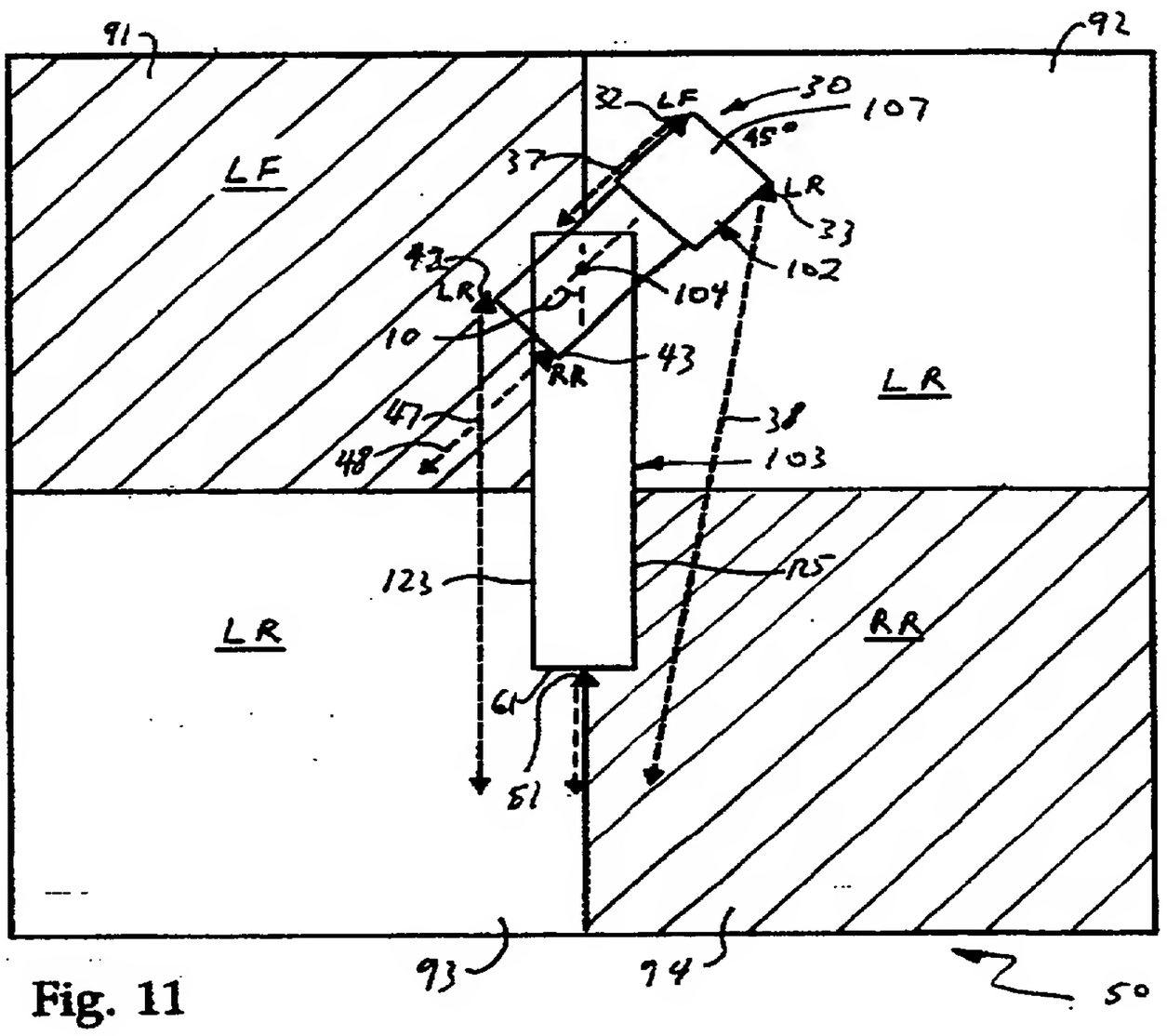

Fig. 11

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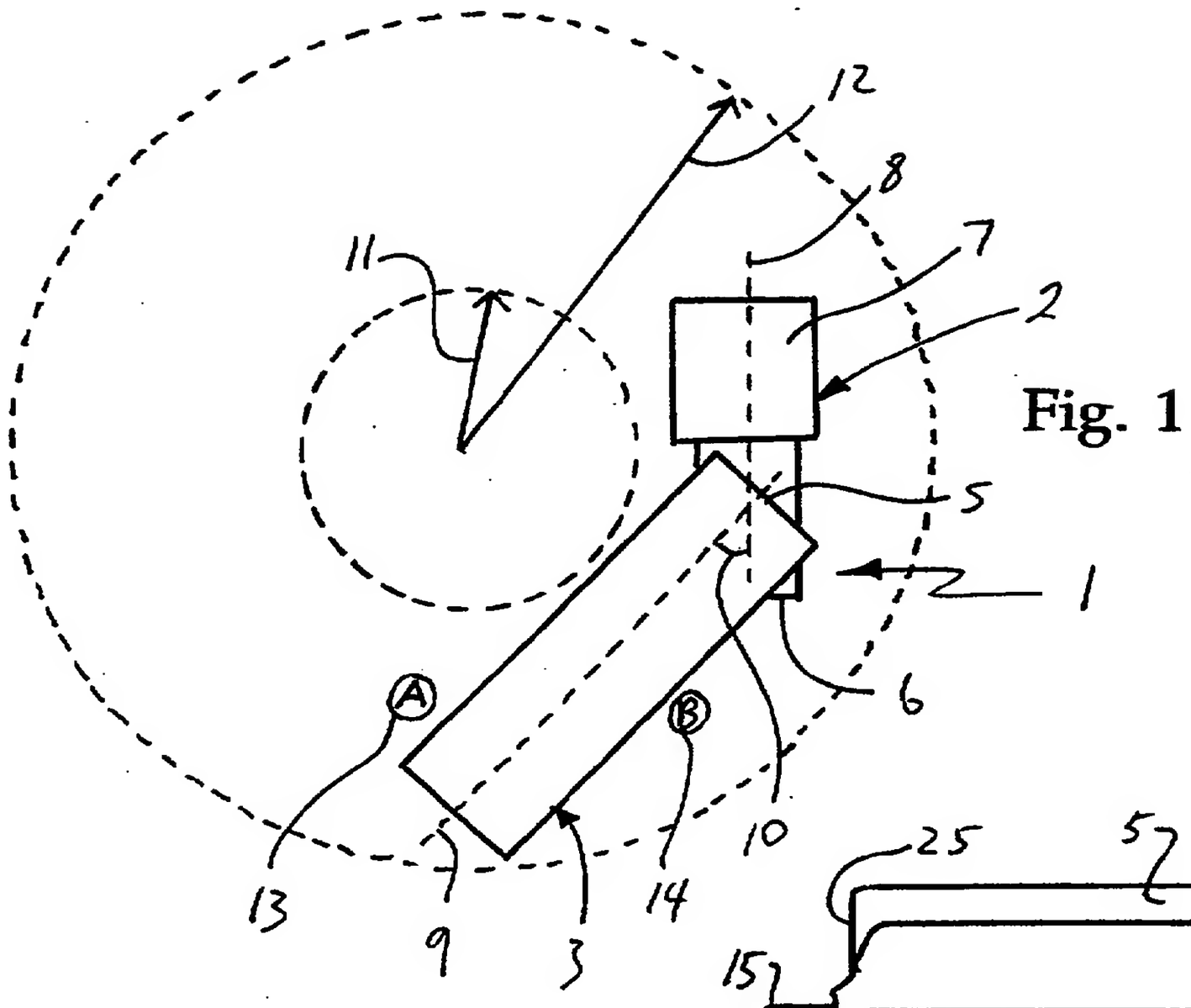


Fig. 1

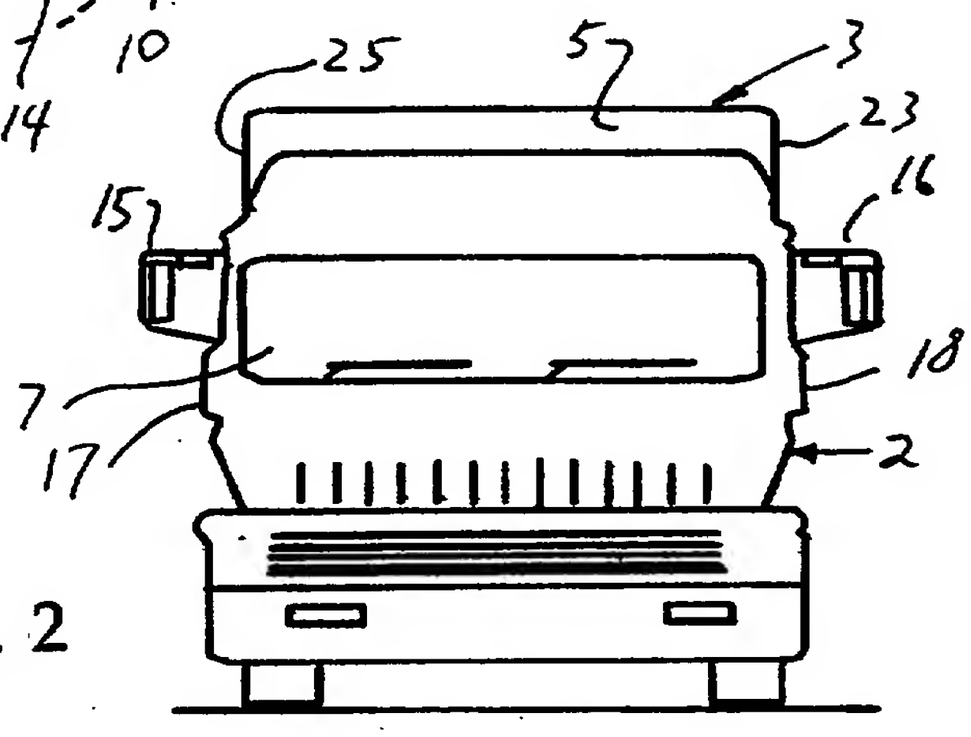


Fig. 2

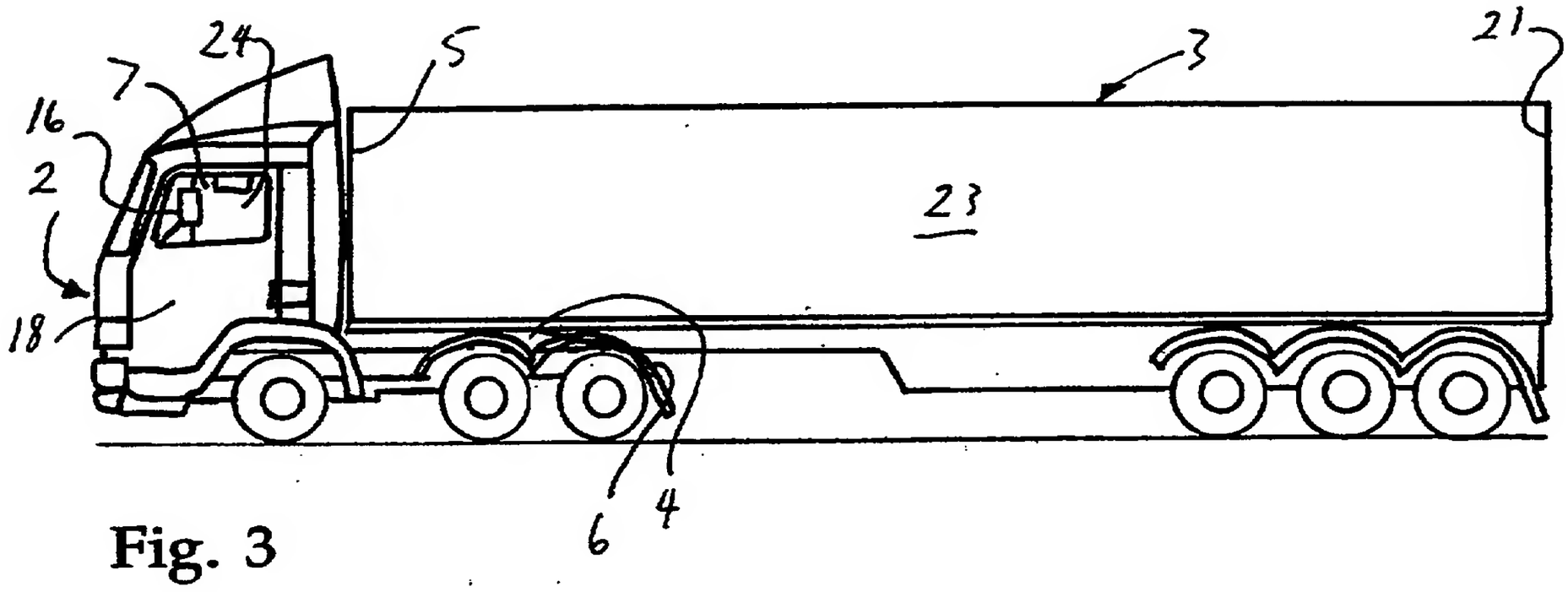


Fig. 3

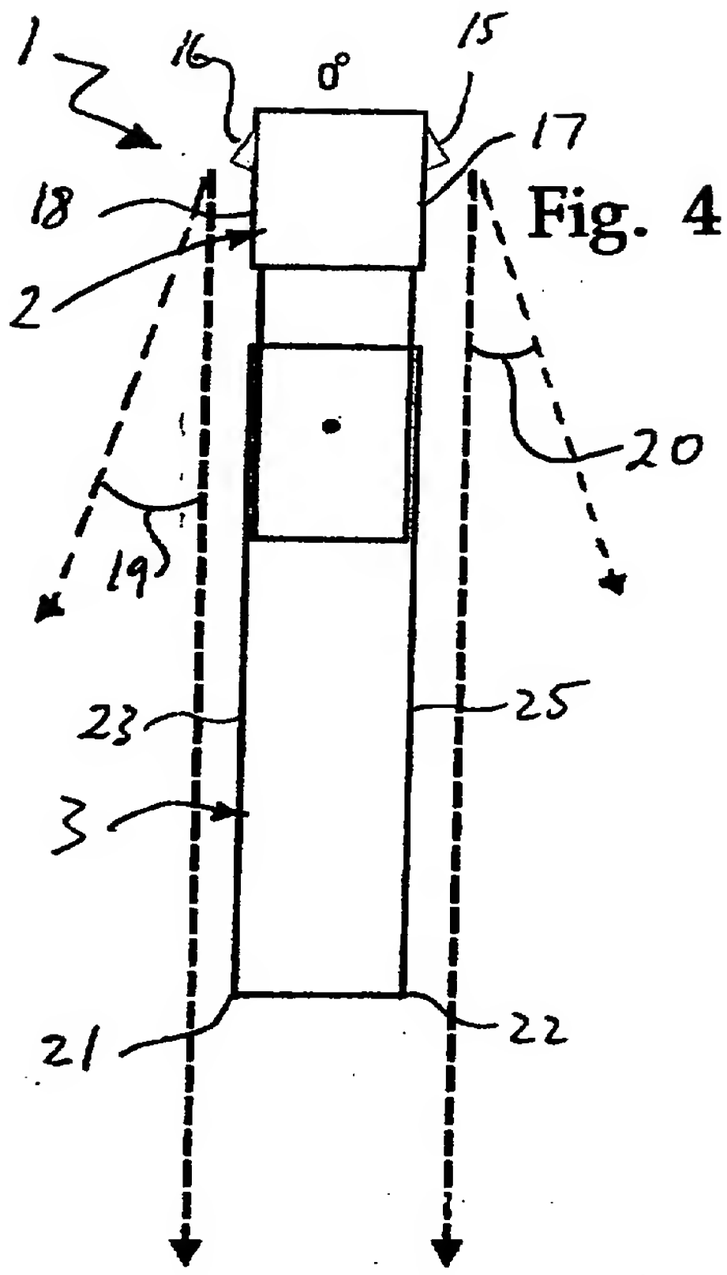


Fig. 4

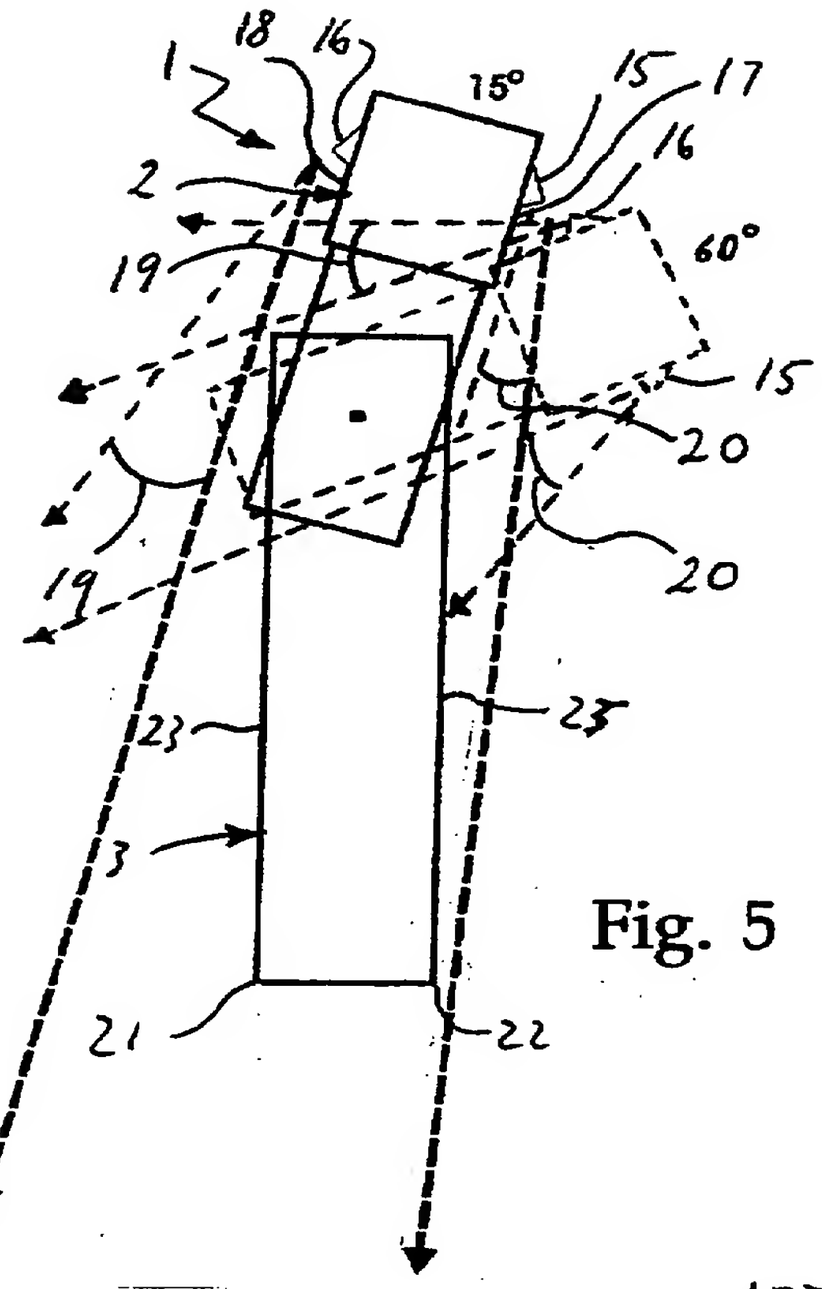


Fig. 5

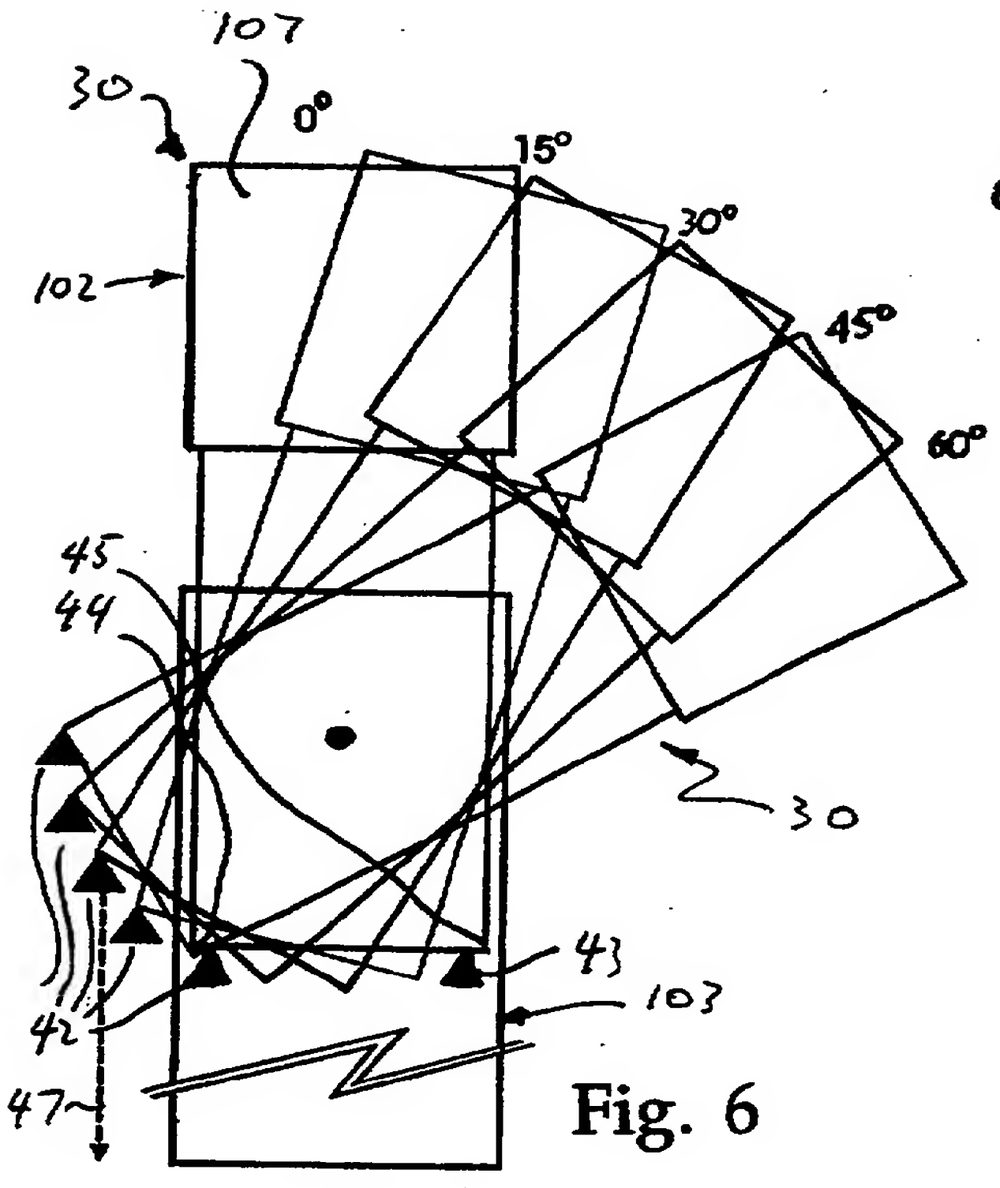


Fig. 6

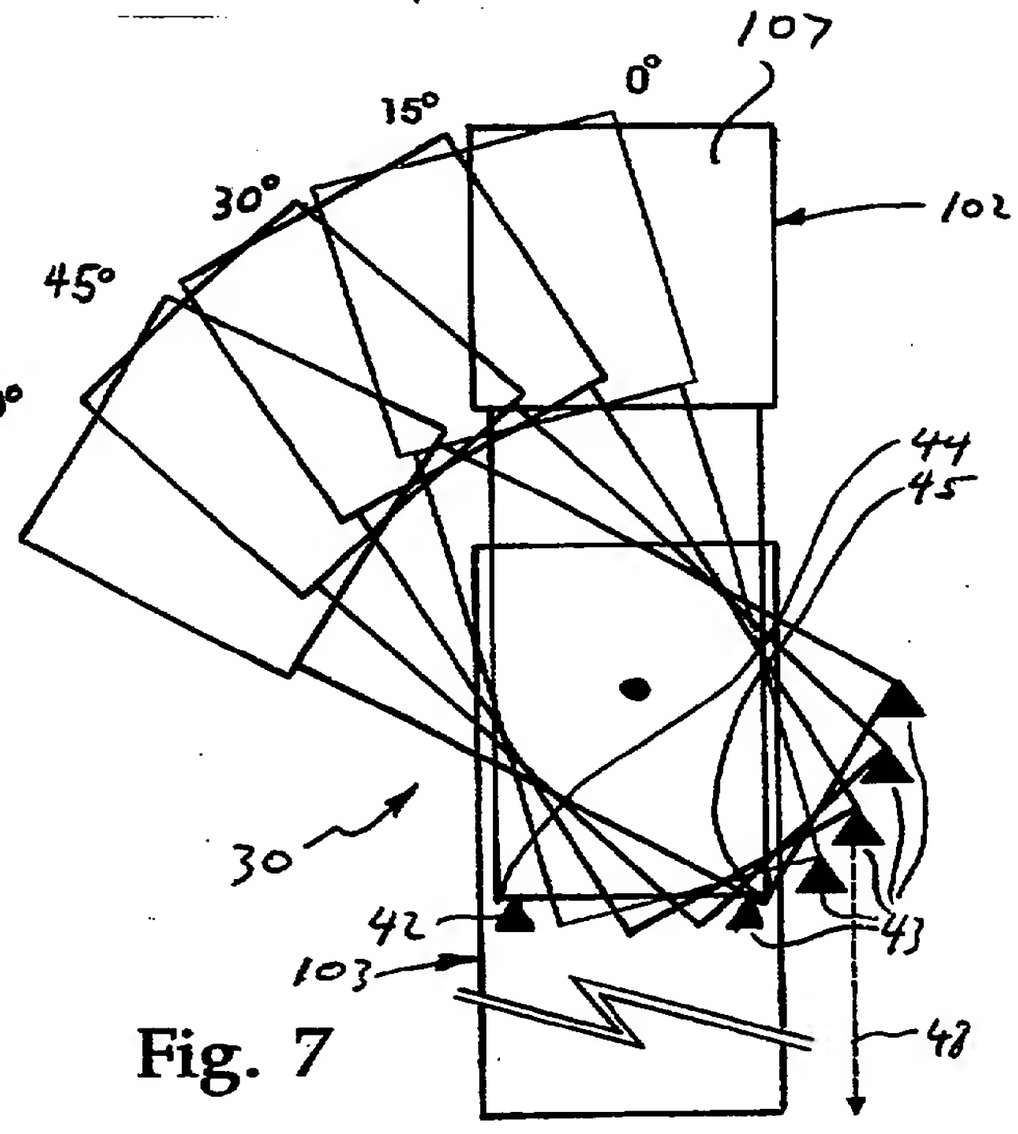


Fig. 7

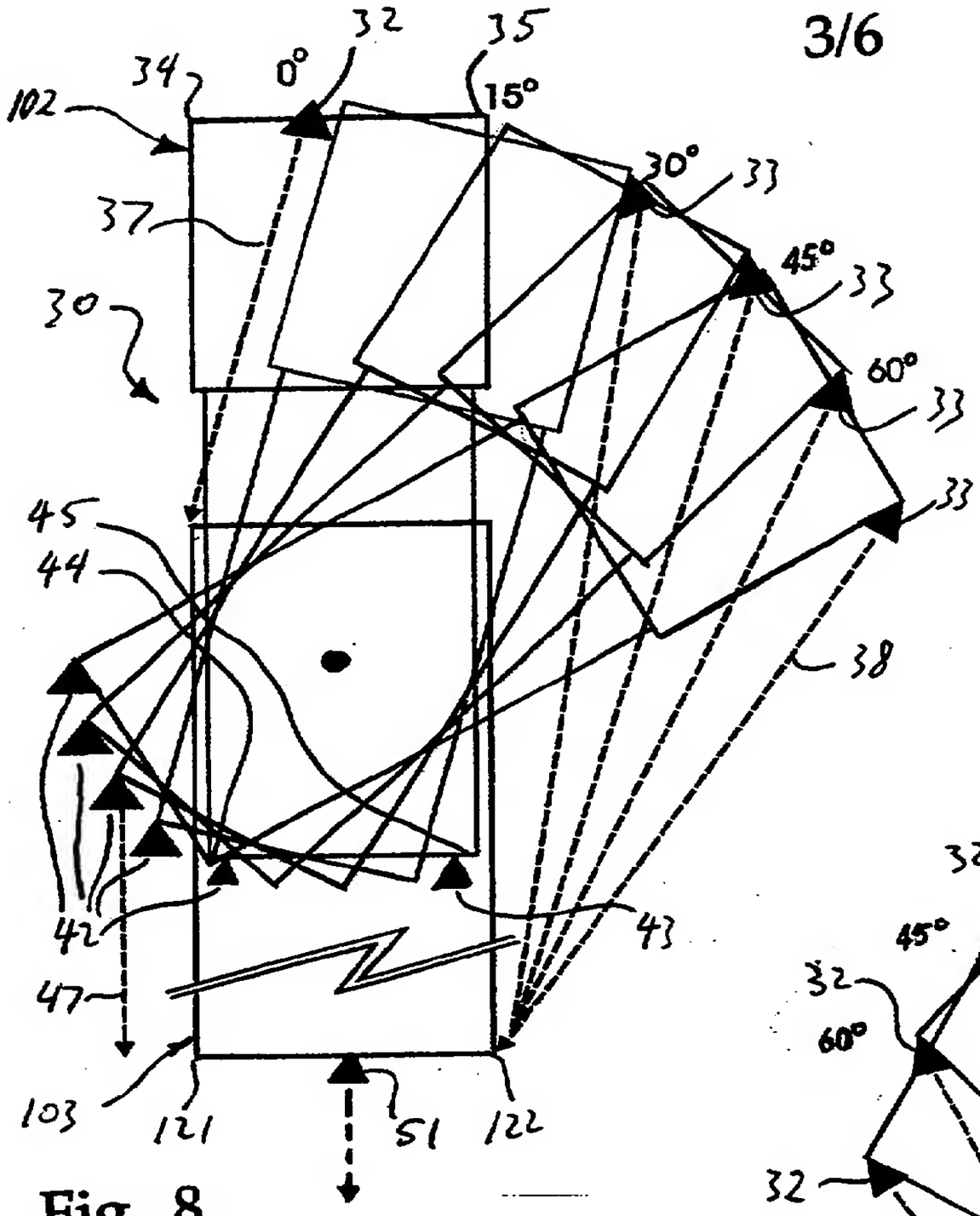


Fig. 8

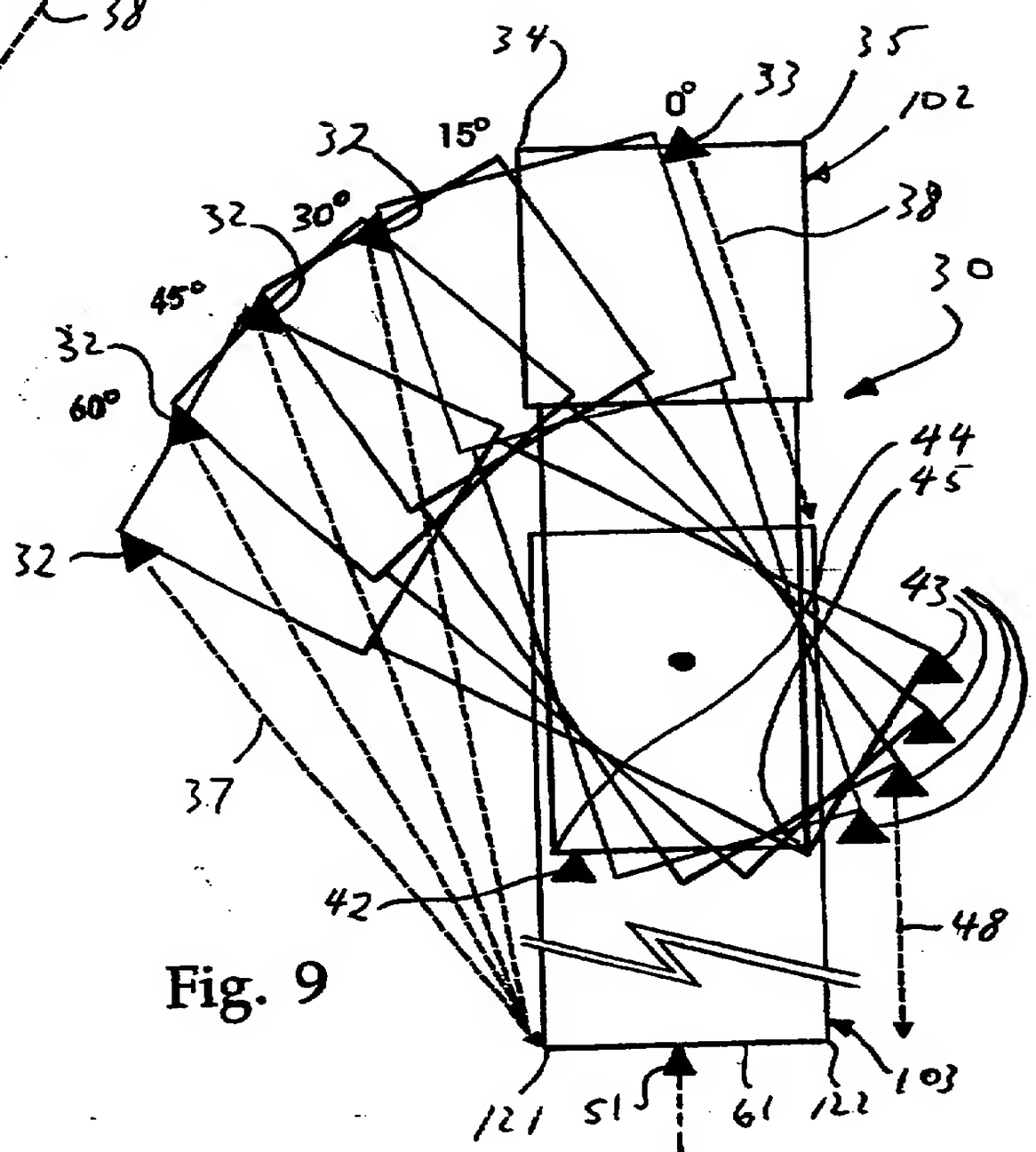


Fig. 9

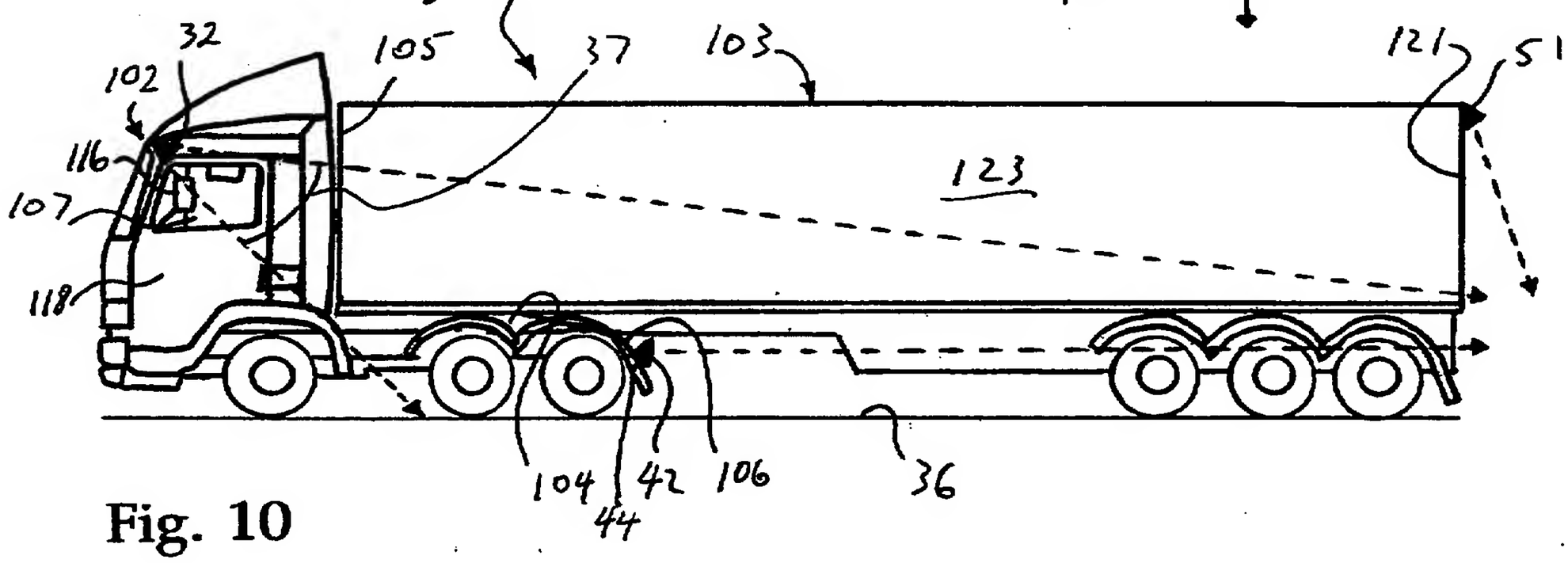


Fig. 10

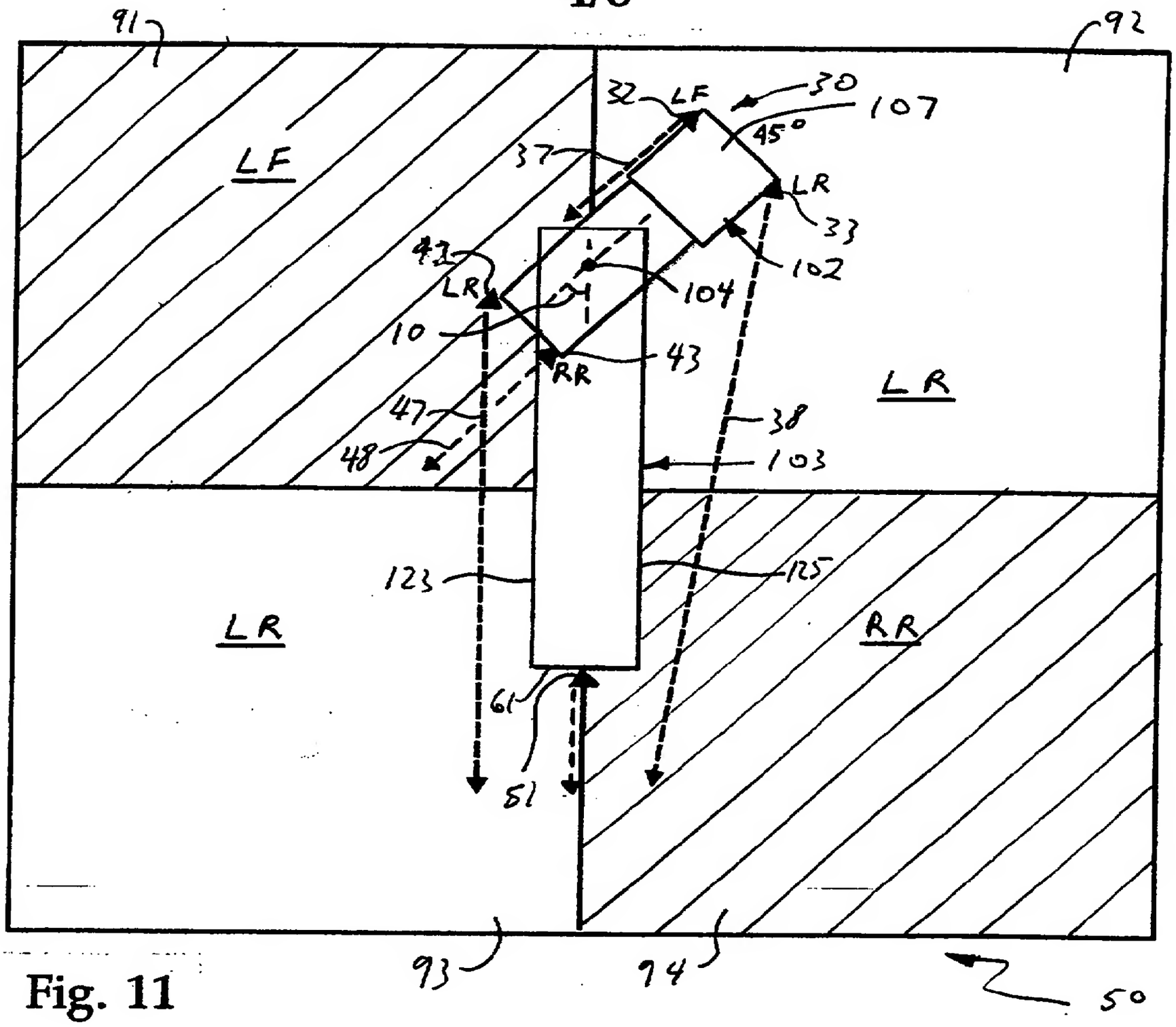
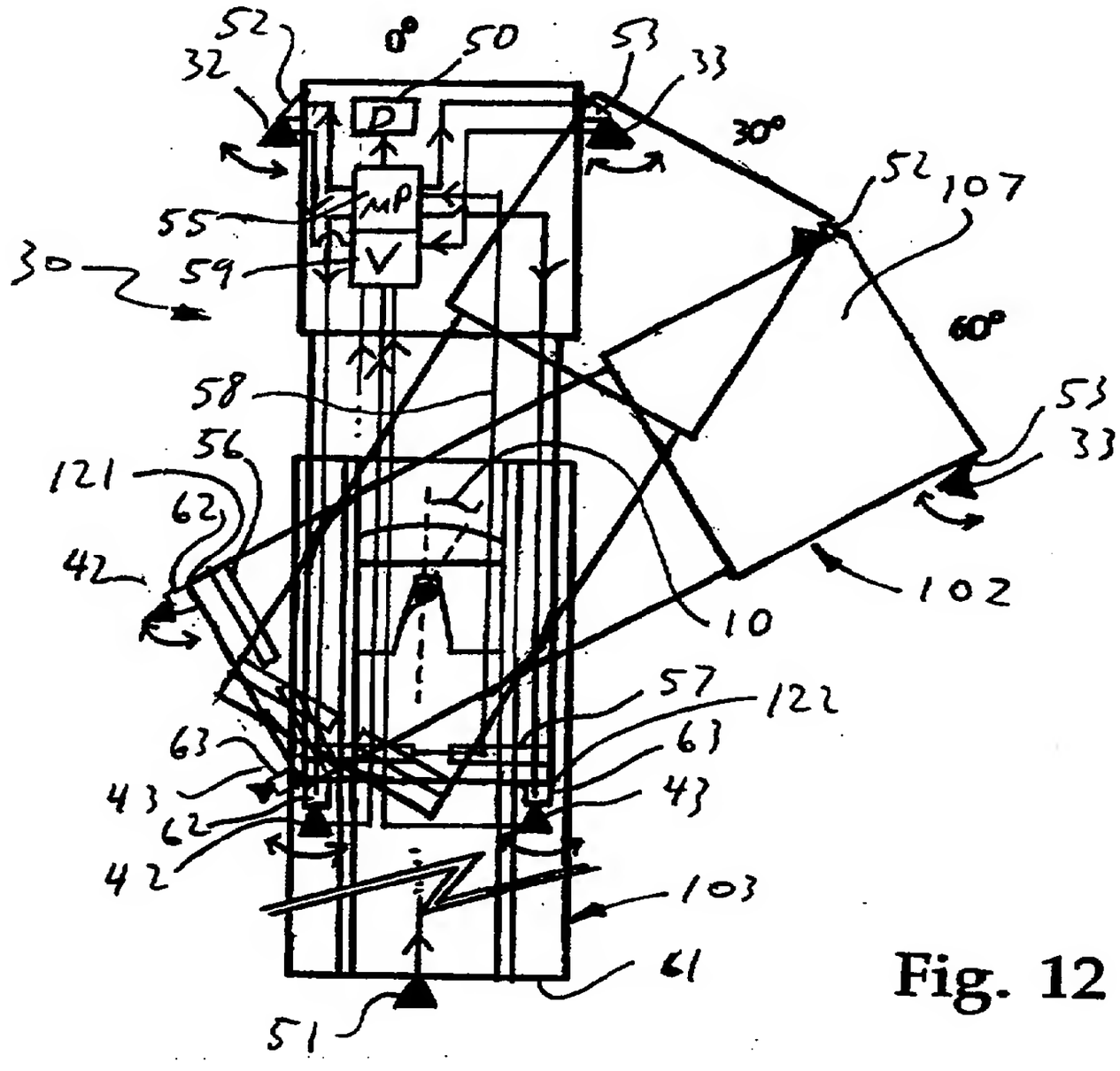

91
92
LF
32
LF
30
107
45°
37
LR
33
43
LR
104
102
10
RR
43
47
38
48
103
LR
123
125
RR
61
51
93
94
50

Fig. 11


52
8°
50
53
32
33
D
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52
107
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V
30
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58
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42
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122
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43
62
42
103
61
51

Fig. 12

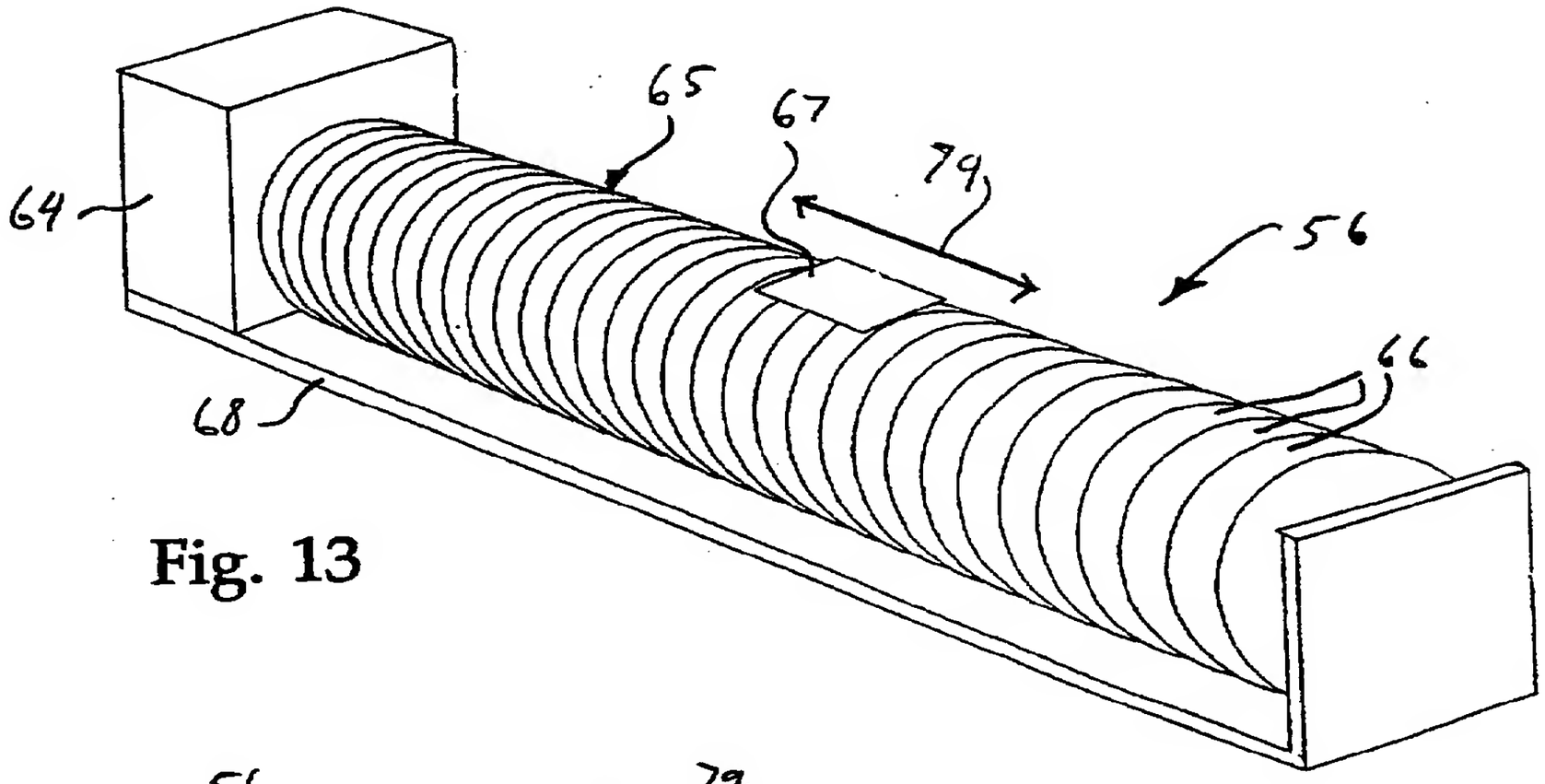


Fig. 13

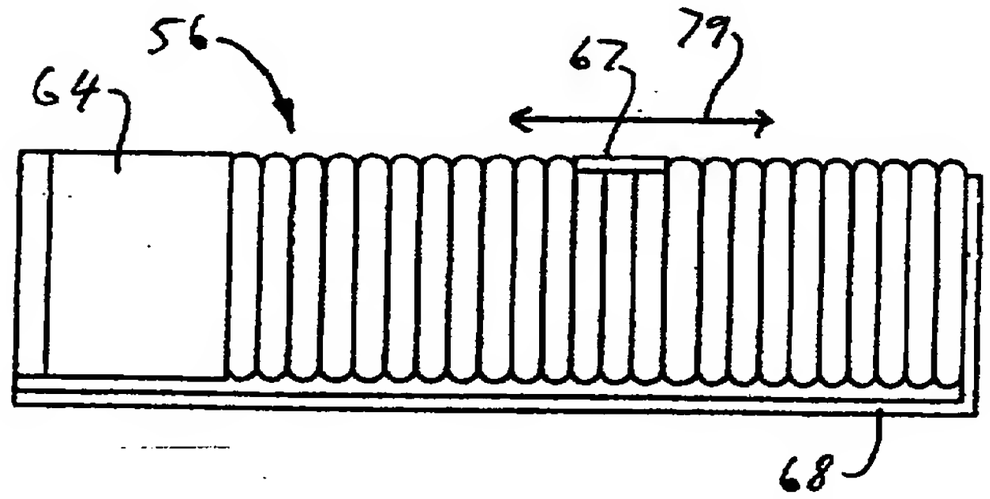


Fig. 14

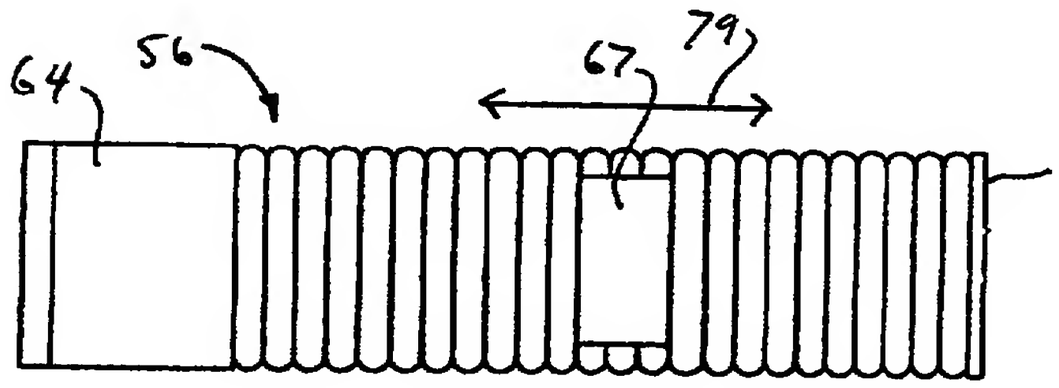


Fig. 15

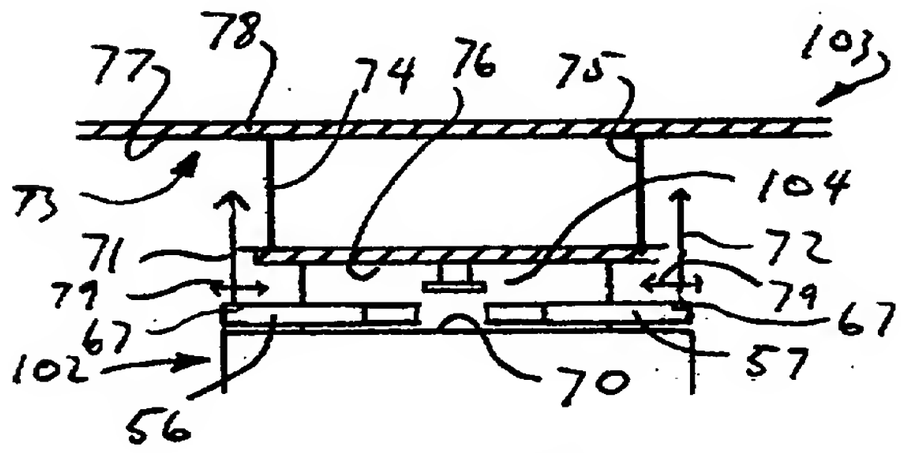


Fig. 17

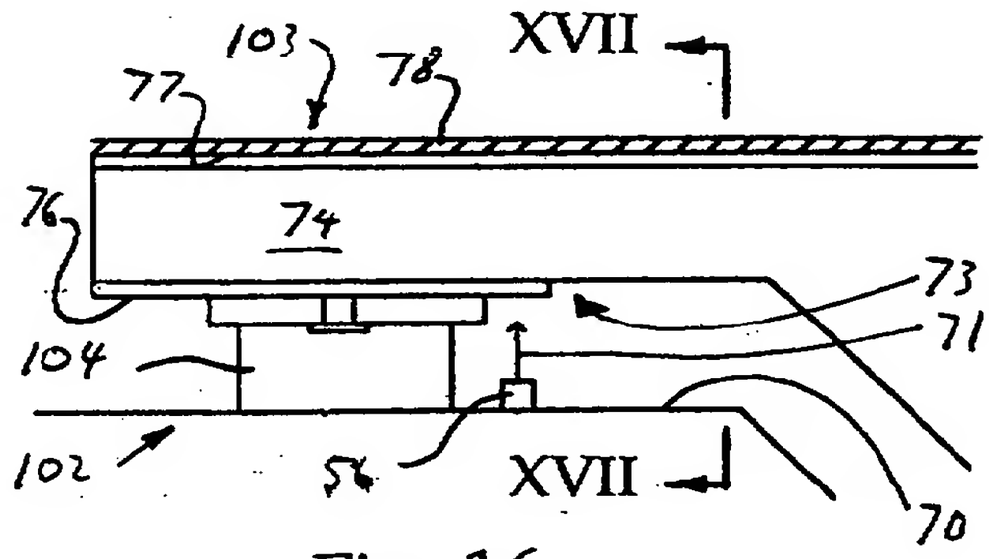
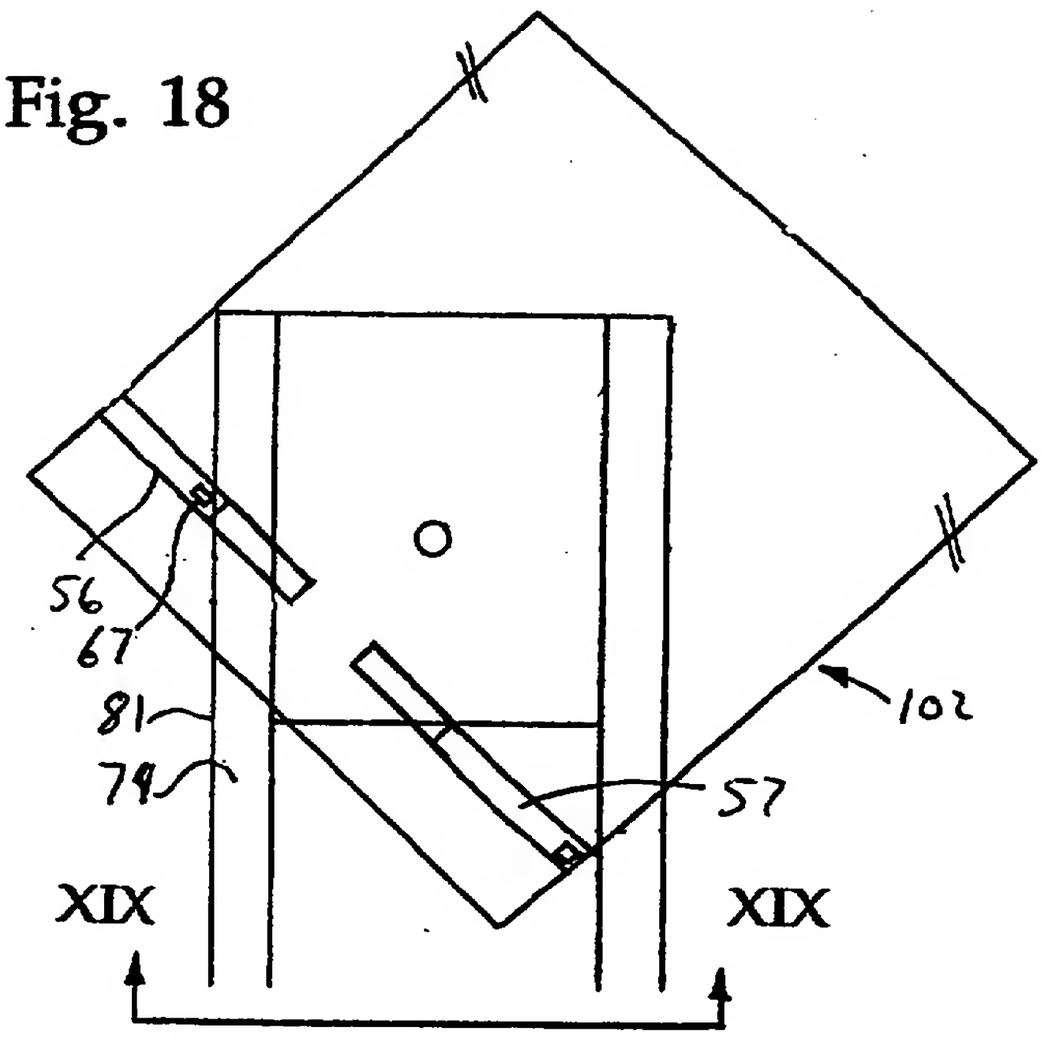


Fig. 16

Fig. 18



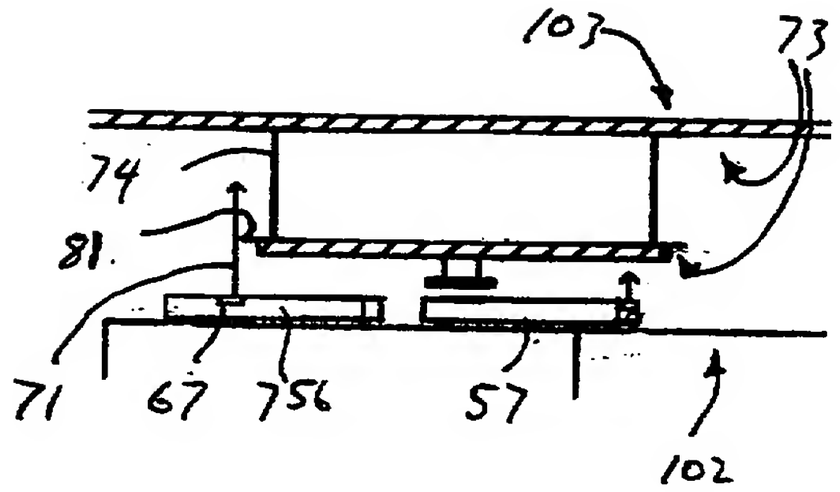


Fig. 19

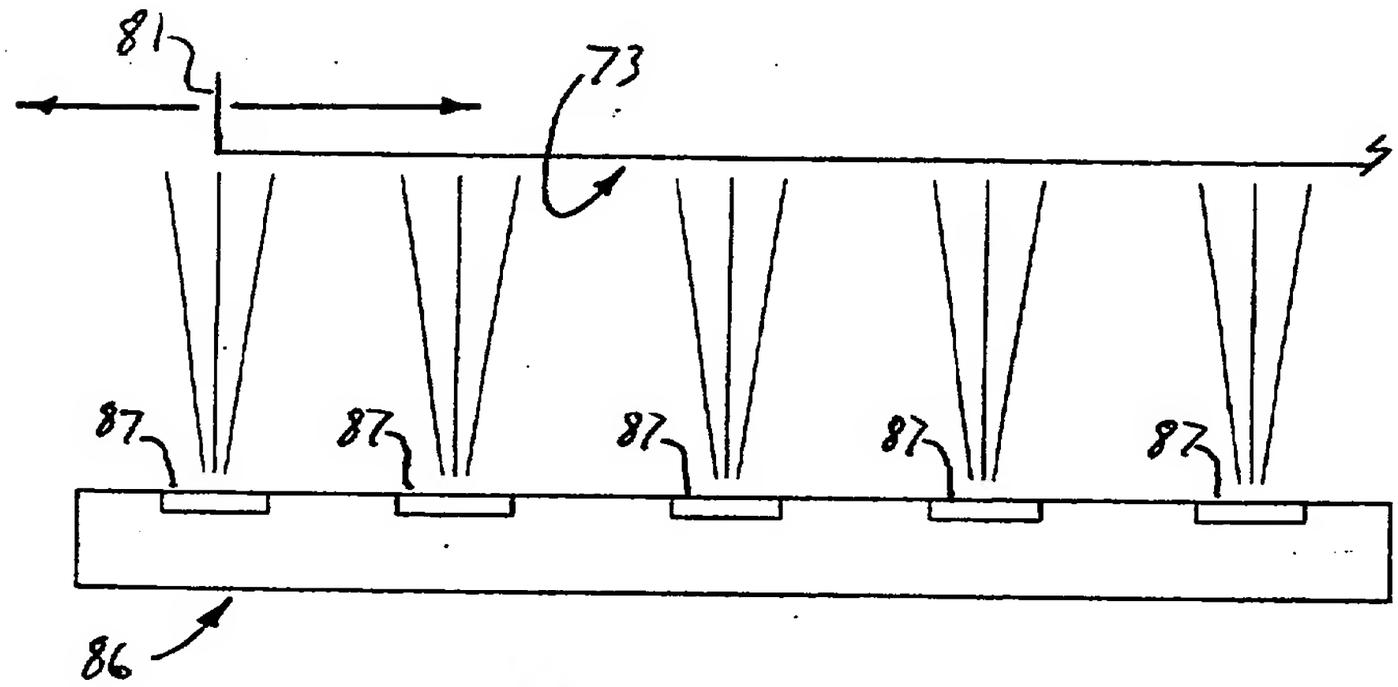


Fig. 20

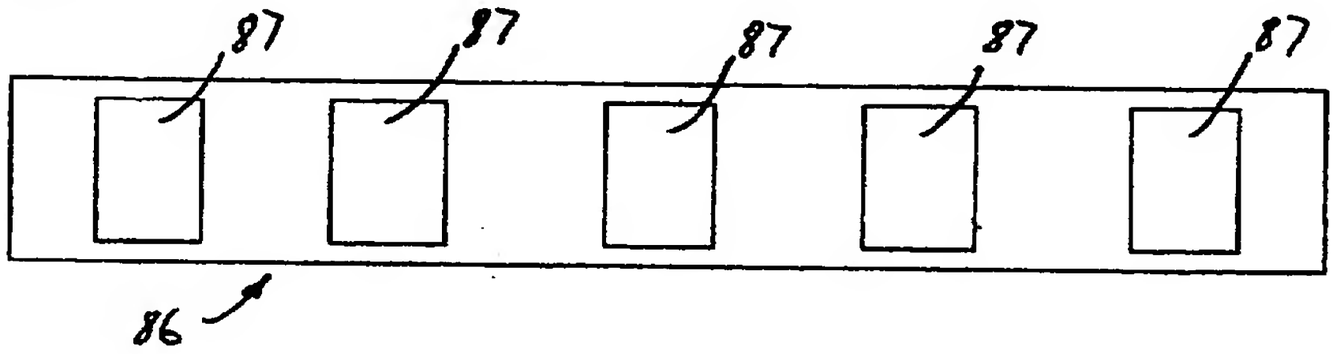


Fig. 21

Articulated Vehicle with Rear View Video Camera

The present invention relates to an articulated vehicle with a rear view video camera.

Articulated vehicle can be difficult to manoeuvre in confined spaces or on public roads where other vehicles or stationery objects may not be visible to the driver when the vehicle is turning. A tractor unit may be coupled to a trailer of up to 14.9 m (45 feet) long, When the turning angle between the such a tractor and trailer units reaches about 10° to 20°, one side of the trailer is no longer visible in a conventional wing mirror system, whist on the other side, the wing mirror will present a view only of the side of the trailer. The driver however, may need to see the rear edge of the trailer in order to make sure that he will not hit any obstacles. The greater the turning angle, the less the visibility. Although additional mirrors may be provided with different fields of view, it is still the case that the side of the trailer on the outside of a turn will become unobservable as the tractor unit and driver cab swings inside the turn.

Although driver may be able to lean out a cab window nearest the steering wheel to get a direct look backwards, it will not be possible for the driver to get a look backwards on the other side without stopping the tractor unit.

Although roads may be designed to reduce the effect of these problems, if a driver from a right-hand drive country takes his vehicle into a left-hand drive country, or *vice versa*, then such problems can be exacerbated.

It is an object of the present invention to provide an apparatus that addresses these issues.

According to the invention, there is provided a tractor unit for towing a rearward trailer unit, the tractor unit comprising: a driver cab; an articulation coupling for connecting the tractor unit to a trailer unit; articulation measurement means for measuring an articulation angle of the tractor unit with respect to a trailer unit coupled to the tractor unit; at least one video camera with a rearward directed field of view; video display means visible to the driver for displaying images from the video camera; and actuation means for moving the camera field of view according to the measured articulation angle so that a desired rearward field of view past a trailer unit coupled to the tractor unit is displayed to the driver on the video display means as the articulation angle changes.

Also according to the invention there is provided an articulated vehicle, comprising a forward tractor unit including a driver cab and a rearward trailer unit, the tractor unit and trailer unit being coupled to each other at an articulation coupling, wherein the vehicle includes: articulation measurement means that provides a measure of the articulation angle of the units; at least one video camera with a rearward directed field of view; video display means visible to the driver for displaying images from the video camera; and actuation means for moving the camera field of view according to the measured articulation angle so that a desired field of view past the trailer unit is displayed to the driver on the display means as the articulation of the vehicle changes.

The articulated vehicle may be a road-going articulated truck, for example of the type having a tractor unit with a fifth wheel articulated coupling for a trailer. The trailer may be a conventional trailer such as a skeletal

trailer for carrying ISO standard container units, a flatbed trailer, a box van, a curtain sided trailer, or any other type of trailer that may be connected to and towed by a tractor unit.

The arrangement may be such that when the tractor unit has a left rear portion as viewed facing in a forwards direction, and the coupling pivots the tractor unit and the trailer unit forwards of the left rear portion of the tractor unit, so that the left rear portion moves outboard left of the trailer unit when the tractor unit turns right, a left rear video camera that is mounted on the left rear portion of the tractor unit has a field of view past the left side of the trailer.

Similarly, the arrangement may be such that when the tractor unit has a right rear portion as viewed facing in a forwards direction, and the coupling pivots the tractor unit and the trailer unit forwards of the right rear portion of the tractor unit, so that the right rear portion moves outboard right of the trailer unit when the tractor unit turns left, a right rear video camera that is mounted on the right rear portion of the tractor unit has a field of view past the right side of the trailer.

The use of a left rear or right rear video camera is particularly advantageous, as it typically provides a view from a vantage point distinct from that of conventional rear view mirrors, which are normally at front left and front right corners of the tractor unit. If just two such left and right rear video cameras are used, the system may comprise two separate video displays, one for each camera, appropriately oriented inside the driver cab, for example on left and right sides of the cab.

The desired field of view may be past a left (or right) rear corner of the trailer.

Thus the turning motion of the tractor is used to advantage to gain a view in the vicinity of the left (or right) rear side of the trailer as the cab swings inboard to the right (or left).

The left (or right) portions may be left (or right) corners of the tractor unit, so that the video camera on that corner is swung outboard by the maximum amount as the trailer turns. This provides a clearer view past the side of trailer so that the driver can better judge the orientation of any obstacles in relation to the length of the trailer.

The arrangement may also be such that when the tractor unit has a left front portion as viewed facing in a forwards direction, and the coupling pivots the tractor unit and the trailer unit rearwards of the left front portion of the tractor unit, so that the left front portion moves outboard left of the trailer unit when the tractor unit turns left, a left front video camera that is mounted on the left front portion has a field of view past the left side of the trailer.

Similarly, the arrangement may also be such that when the tractor unit has a right front portion as viewed facing in a forwards direction, and the coupling pivots the tractor unit and the trailer unit rearwards of the right front portion of the tractor unit, so that the right front portion moves outboard right of the trailer unit when the tractor unit turns right, a right front video camera that is mounted on the right front portion of the tractor unit has a field of view past the right side of the trailer.

Thus the turning motion of the tractor is used to advantage to gain a view in the vicinity of the left (or right) rear corner of the trailer as the cab swings inboard to the left (or right).

When there are both left and right rear and left and right front video cameras, video images from the cameras may be displayed on the video display means together in an orientation corresponding with location of the camera on the vehicle. For example, if the video display is a square or rectangular display, the right front images may be displayed in a right front, or an upper right, corner of the display, and the left rear images may be displayed in a left rear, or a lower left, corner of the video display.

Preferably, the video display means does not display images from a camera if that camera does not have a desired field of view past a rear corner of the trailer. Thus, the attention of the driver will be directed towards images which provide potentially useful scenes behind the driver cab.

The desired field of view may include also a view past a left (or right) rear corner of the trailer.

It will generally be the case that a forwards portion of the trailer unit extends above a rearwards portion of the tractor unit in the vicinity of the articulation coupling between the units. The articulation measurement means may then comprise at least one detection beam source and at least one detection beam receiver. The trailer articulation measurement means can then be affixed to one of the units, preferably the tractor unit in order to avoid extra electrical connections between the units, and project towards the other unit one or more of the detection beams. Reflections of the detection beams

received by the detection beam receiver off said other of the units can then be used by the articulation measurement means to measure the degree of articulation.

The term "reflection" used herein includes both regular reflection, diffuse reflection or any form or scattering.

The detection beam may be an electromagnetic beam, for example an infrared beam from an infrared light emitting diode. Alternatively, the detection beam may be an acoustic beam, for example an ultrasonic beam from an ultrasonic transducer.

The beams may be pulsed or otherwise modulated in order to increase the detection sensitivity and reject spurious signals.

In one embodiment of the invention, the articulation measurement means has a beam actuator that moves one or more of the sources of the detection beams, so that the detection beams may detect a detection beam reflecting feature of said other unit as the detection beam is moved over the detection beam reflecting feature.

The detection beam may then be moved, for example by scanning the beam back and forth so that it crosses the underside of the trailer. A feature such as an edge of the trailer may then be detected where the detection beam is not reflected.

In another embodiment of the invention, there is a plurality of detection beam sources arranged linearly, for example in a direction transverse to the length of the trailer. As the trailer turns, the different detection beams will then pass over different portions of the

underside of the trailer. Again, this allows detection of a feature such as an edge of the trailer.

In one embodiment of the invention, the beam actuator is a mechanical actuator that moves one or more of the sources between left and right limits. This has the advantage that only one sensor and receiver need to be provided. There is then no need to maintain calibration between different sources and receivers.

In another embodiment of the invention, there is a plurality of detection beam sources arranged linearly. This has the advantage that there need be no moving mechanical parts.

The invention will now be described in more detail, by way of example with reference to the accompanying drawings, in which:

Figure 1 is a view from above of a conventional articulated tractor and trailer units showing the inner and outer turning radii;

Figures 2 and 3 are respectively front and side views of conventional articulated tractor and trailer units, showing the usual locations of side rear view mirrors;

Figures 4 and 5 are views from above of the convention articulated tractor and trailer units showing the limits of the fields of view from the rear view mirrors when the units are respectively straight and turning;

Figures 6 and 7 are views of an articulated vehicle according to the invention having a tractor unit and

a trailer unit when the vehicle is turning respectively right or left, with a pair of rear view video cameras at opposite back lower corners of the tractor unit;

Figures 8 and 9 are views of the articulated vehicle similar to those of Figures 6 and 7, but with an additional pair of rear view video cameras at opposite front upper corners of the tractor unit;

Figure 10 is a side view of the articulated vehicle of Figure 9 showing the elevations of the pairs of the rear view video cameras;

Figure 11 is a schematic view from above of the vehicle of Figure 9 superimposed on a video display unit with display segments corresponding to the two pairs of video cameras;

Figure 12 is a schematic drawing showing articulation measurement sensors and control electronics linked to the rear view video cameras;

Figures 13 to 16 are expanded views of the articulation measurement sensor;

Figures 17 to 19 show in more detail the operation of the articulation measurement sensors; and

Figures 20 and 21 show views of another type of articulation measurement sensor.

Figures 1, 2 and 3 shows views from above of a conventional articulated truck 1 comprising a forwards tractor unit 2 and a following trailer 3. The tractor unit 2 is connected to the trailer unit 3 by a conventional

fifth-wheel articulation coupling 4 that is between the units and that lies between a forwards edge 5 of the trailer unit 3 and a rearwards edge 6 of the tractor unit 2. The tractor unit 2 has a cab 7 of a similar width to the trailer unit 3. The width and length of the trailer unit 3 may vary within limits defined by national law, for example in Europe up to 2.55 metres wide and up to 14.9 metres long.

When the truck 1 turns a corner, as shown in Figure 1, longitudinal axes 8,9 of the tractor and trailer units 2,3 will lie at an articulation angle 10 to each other when the truck 1 is manoeuvring, this angle 10 may vary up to a maximum of 90°, but is more typically between 15° and 45°. Because the widths of the tractor and trailer units 2,3 are comparable, and because the fifth wheel coupling 4 lies between the forward edge 5 of the trailer unit 3 and the rear edge 6 of the tractor unit 2, both the tractor unit 2 and the trailer unit 3 will swing outboard (i.e. radially outwards) and inboard (i.e. radially inwards) with respect to each other. As a result, the distance between the inner and outer radii 11,12 of a turn can far exceed the width of either the tractor or trailer units 2,3. Therefore, when the truck is turning and moving either forwards or backwards, any obstacles between the inner and outer radii 11,12, such as those marked "A" 13 and "B" 14 are at risk of being hit by the truck if a driver does not have a view of such obstacles 13,14.

As shown in Figures 2 and 3, the tractor unit 2 is therefore provided with rear view mirrors 15,16 on the left and rights sides 17,18 of the tractor unit 2 within view of the driver in the cab 7. The mirrors 15,16 are usually positioned as far outwards from the cab 7 as is practical without creating a significant risk of the

mirrors 15,16 striking objects at the side of a road or an oncoming vehicle.

Figures 4 and 5 show how such a conventional arrangement of mirrors 15,16 gives a field of view 19,20 past left and right sides 23,25 of the trailer unit 3 that encompasses also the vicinity of left and right rear corners 21,22 of the trailer unit 3 when the tractor and trailer units 2,3 are straight. As shown in Figure 5, when the articulation angle 10 between the longitudinal axes 8,9 of the tractor and trailer units 2,3 reaches about 10° to 20°, the field of view 19 on the side of the truck 1 away from the turn can no longer encompass the trailer side 23 or the vicinity of the rear corner 21 of the trailer unit 3 on the side away from the turn, even if the mirror 16 on that side is supported well away from the side 18 of the tractor unit 2. At the same time, the field of view 20 on the inside of the turn becomes directed at the side 25 of the trailer unit 3 inside the turn. Even if a wide view mirror segment (not shown) is used in a mirror 15 inside the turn, by the time the turn angle has reached 60°, the field of view 20 on the side of the truck 1 inside the turn will inevitably be directed only at the side 25 of the trailer unit 3 inside the turn. The driver then no longer has a view of the rear corner 22 of the trailer unit inside the turn. Of course, if the driver is seated on the side of the cab 7 inside the turn, he may look out a side window 24 to gain a view of a rear corner 21,22 of the tractor unit 3. This, however, may be inconvenient and of course the driver may be seated on the wrong side of the tractor unit 2 to gain such a view.

Figures 6 to 10 show an articulated truck 30 according to the invention. Parts of the truck 30 similar to those of the conventional truck 1 are numbered with the same reference numerals incremented by 100. The articulated

truck 30 has a front pair of rear view video cameras 32,33 mounted respectively on the tractor unit 102 at upper left and upper right corners 34,35 of the tractor unit. Each of the forwards pair of video cameras 32,33 is directed backwards and down towards a road surface 36 to the left and right sides 123,124 of the trailer unit 103, so that each of the forwards video cameras 32,33 has a field of view 37,38 past left or right sides 123,125 of the trailer 103 towards the vicinity of a rear corner 121,122 of the trailer unit 103 when the tractor and trailer units 102,103 are straight.

The articulated truck 30 also has a rear pair of rear view video cameras 42,43 mounted respectively on the tractor unit 102 at lower left and lower right corners 44,45 of the tractor unit. Each of the rearwards pair of video cameras 42,43 is directed backwards parallel to the road surface 36 to the left and right sides 123,124 of the trailer unit 103, so that each of the rearwards video cameras 42,43 has a field of view 47,48 past left or right sides 123, 125 of the trailer unit 103. Because the left or right rear corners 44,45 of the tractor unit 102 swing outboard of the trailer unit 103 when the truck is turning respectively either right or left, it is not practical for the left and right rear video cameras 42,43 to be mounted laterally outwards from the left and right rear corners 44,45. The left and right rear cameras 42,43 are therefore protectively mounted laterally inside of the left and right rear corners 44,45 of the tractor unit 102. The left and right rear cameras 42,43 therefore have a field of view past respectively the left or right sides 123,125 of the trailer unit 103 only when the truck 30 is turning respectively either right or left. It will be noted, however, that the view 47,48 from the left and right rear cameras 42,43 becomes available as the corresponding left

or right view 37,38 from the forwards left or right video cameras 32,33 becomes obscured by the turn.

Figure 11 shows schematically the screen of a display unit 50 which would normally be provided within the driver cab 107. The screen display is divided into four quadrants so that up to four images 91,92,93,94 can be displayed. For illustrative purposes only, superimposed on the display unit 50 is a sketch of an articulated truck 30 performing a 45° turn to the right. In this orientation, the front left camera 32 and the rear right camera 43 swing respectively inboard and outboard with respect to the left and right sides 123,125 of the trailer unit 103. These cameras 32,43 therefore no longer have a field of view 37,48 past respective left and right sides 123,125 of the trailer unit 103.

The other two cameras, here the left rear camera 42 and left front camera 33, swing respectively outboard and inboard of the turn so that each camera moves relatively further outwards with respect to the left and right sides 123,125 of the trailer unit 103. It is therefore possible when the articulated truck 30 is turning to orient at least one camera on each side of the truck 30 so that a rearwards view past the left and right sides 123,125 of the trailer unit 103 is provided on the video display unit 50. To direct the driver's attention only to the most useful images 91,92,93,94 from the video cameras 32,33,42,43, the video display orients images from each camera similarly left/right and up/down (or forward/rearwards) to the positioning of the cameras on the tractor unit 102. In addition, the video display 50 and also displays blank images as indicated by the diagonal lines for image quadrants 91,94 when no useful image is provided by any particular camera.

Optionally, the articulated truck 30 has a fifth rearward directed video camera 51 mounted centrally in an upper central portion of the rear surface 61 of the trailer unit 103. Since the truck 30 conventionally has a transmission with forwards and rearwards gears and means for detecting the selection by the driver of a rearwards gear (for example to illuminate reversing lights), the processor 55 can be provided with a signal indicating selection of a reverse gear to provide on the video display 50 a view from the rearwards directed video camera 51 when the driver selects a rearwards gear.

As shown in Figure 12, the side rear view video cameras 32,33,42,43 each have a corresponding actuator 52,53,62,63 to pivot each camera left and right. Each of the actuators 52,53,62,63 is wired to a central processor unit 55 that controls the left/right orientation of each camera according to a measured articulation angle 10 between the tractor unit 102 and trailer unit 103. The articulation angle 10 is measured by a pair of articulation measurement sensors 56,57 mounted near left and right rear corners 121,122 of the tractor unit 103. The articulation measurement sensors 56,57 provide an output 58 representative of articulation angle 10 to the processor 55, and depending on the measured articulation angle, the processor alters the left/right orientation of video cameras 32,33,42,43 so that these provide the best view past the left and right sides 123,125 of the trailer unit 103.

The processor 55 also controls a video unit 59 that receives inputs from each of the four video cameras 32,33,42,43 so that the appropriate images are provided to the video display unit 50.

Figures 13 to 15 show the first embodiment of one of the articulation measurement sensors 56 (or 57). This comprises a motor and control unit 64 at one end of an elongate linear actuator that moves a pleated cylindrical bellows 65 so that the pleats either bunch towards or away from the motor and control unit 64. Attached to the outside of the bellows 65 is an ultrasonic sensor 67 including both an ultrasonic transmitter and receiver.

With reference now also to Figures 17 to 19, in use, the articulation measurement sensors 56, 57 are each mounted via an L-shaped supporting bracket 68 beneath and to one end of the bellows 65 to an upwardly facing surface 70 behind the fifth-wheel articulation coupling 104. Each articulation measurement sensor 56,57 is mounted so that the ultrasonic sensor 67 faces upward to direct an ultrasonic beam 71,72 towards an underside 73 of the trailer unit 103. This trailer unit underside 73 will normally comprise different features at different separations from the ultrasonic sensor 67, such as longitudinal I-beam chassis members 74,75, a fifth-wheel coupling plate 76, or the under-surface 77 of a trailer floor 78. Therefore, depending on the relative left/right orientation of the ultrasonic sensor 67 and features of the trailer under-surface 73, ultrasonic pulses emitted by the ultrasonic sensor 67 will be detected with varying time delays and at various intensities. This can be used in an initial calibration of the system to deduce the relative position of particular features of the trailer under-surface features 73, such as the edges of the I-beams 74,75, edges of the coupling plate 76, or edges of the trailer floor 78.

In order to provide a more accurate measurement, each of the ultrasonic sensors 67 scans laterally back and forth as indicated by the double headed arrow 79 in order to

scan across identifiably ultrasonic reflection features in the trailer under-surface 73.

The length and arrangement of the articulation measurement sensors 56,57 in the transverse direction should be sufficient so that at least one of the sensors 56,57 can provide a measurement of a transverse edge feature of the trailer under surface for expected turn radii of the articulated truck 30. For example, in Figures 18 and 19, one of the articulation measurement sensors 56 has an ultrasonic sensor 67 that can be positioned transversely to direct a beam 71 of ultrasonic waves upwards to detect an edge 81 of one of the I-beams 74.

Figures 20 and 21 show an alternative articulation measurement sensor 86 that can be used in place of either of the articulation measurement sensors 56,57 described above. The articulation measurement sensor 86 has a plurality of ultrasonic sensors 87 spaced transversely along the articulation measurement sensor 86. Each of the ultrasonic sensors has an ultrasonic transmitter and receiver. The spacing and number of sensors is sufficient so that at least one sensor can detect a feature on the under-surface 73 of the trailer unit 103, such as the edge 81 of the I-beam 74. This sensor therefore does not need any moving parts in order to detect a suitable feature giving a measure of the articulation angle 10 between the tractor and trailer units 102,103.

The invention therefore provides an apparatus by which the driver of an articulated vehicle can view on a visual display unit rearward views past the sides of a trailer unit in order to avoid obstacles when manoeuvring the articulated vehicle.

Claims:

1. A tractor unit for towing a rearward trailer unit, the tractor unit comprising: a driver cab; an articulation coupling for connecting the tractor unit to a trailer unit; articulation measurement means for measuring an articulation angle of the tractor unit with respect to a trailer unit coupled to the tractor unit; at least one video camera with a rearward directed field of view; video display means visible to the driver for displaying images from the video camera; and actuation means for moving the camera field of view according to the measured articulation angle so that a desired rearward field of view past a trailer unit coupled to the tractor unit is displayed to the driver on the video display means as the articulation angle changes.

2. An articulated vehicle, comprising a forward tractor unit including a driver cab and a rearward trailer unit, the tractor unit and trailer unit being coupled to each other at an articulation coupling, wherein the vehicle includes: articulation measurement means that provides a measure of the articulation angle of the units; at least one video camera with a rearward directed field of view; video display means visible to the driver for displaying images from the video camera; and actuation means for moving the camera field of view according to the measured articulation angle so that a desired field of view past the trailer unit is displayed to the driver on the display means as the articulation of the vehicle changes.

3. An articulated vehicle as claimed in Claim 2, the tractor unit having a left (or right) rear portion as viewed facing in a forwards direction, in which the coupling pivots the tractor unit and the trailer unit forwards of the left (or right) rear portion of the

tractor unit, the left (or right) rear portion moving outboard left (or right) of the trailer unit when the tractor unit turns right (or left), a left rear (or right rear) video camera being mounted on the left (or right) rear portion of the tractor unit with a field of view past a left (or right) side of the trailer.

4. An articulated vehicle as claimed in Claim 2 or Claim 3, the tractor unit having a left (or right) front portion as viewed facing in a forwards direction, in which the coupling pivots the tractor unit and the trailer unit rearwards of the left (or right) front portion of the tractor unit, the left (or right) front portion moving outboard left (or right) of the trailer unit when the tractor unit turns left (or right), a left front (or right front) video camera being mounted on the left (or right) front portion of the tractor unit with a field of view past the left (or right) side of the trailer.

5. An articulated vehicle as claimed in Claim 4 when appendant from Claim 3, in which there are both left rear and right rear video cameras, and both left front and right front video cameras, video images from the cameras being displayed on the video display means together in an orientation corresponding with location of the camera on the vehicle.

6. An articulated vehicle as claimed in any of Claims 2 to 5, in which the video display means does not display images from a camera when said camera does not have a desired field of view past a side of the trailer.

7. An articulated vehicle as claimed in any of Claims 2 to 6, in which a forwards portion of the trailer unit extends above a rearwards portion of the tractor unit in the vicinity of the articulation coupling between the

units, the articulation measurement means comprises at least one detection beam source and at least one detection beam receiver, and the trailer articulation measurement means is affixed to one of the units and projects towards the other unit one or more of the detection beams and receives with said detection beam receiver reflections of said detection beams off said other of the units, the articulation angle being determined by the articulation measurement means from the received detection beams.

8. An articulated vehicle as claimed in Claim 7, in which the detection beam is an electromagnetic beam.

9. An articulated vehicle as claimed in Claim 7, in which the detection beam is an acoustic beam.

10. An articulated vehicle as claimed in any of Claims 7 to 9, in which the articulation measurement means has a beam actuator that moves one or more of the sources of the detection beams, so that the detection beams may detect a detection beam reflecting feature of said other unit as the detection beam is moved over the detection beam reflecting feature.

11. An articulated vehicle as claimed in Claim 10, in which the beam actuator is a mechanical actuator that moves one or more of the sources between left and right limits.

12. An articulated vehicle as claimed in any of Claims 7 to 9, in which there is a plurality of detection beam sources arranged linearly.

13. An articulated vehicle as claimed in any of Claims 7 to 12, in which the articulation measurement means is affixed to the tractor unit.

14. An articulated vehicle as claimed in any of Claims 2 to 13, in which the vehicle has a transmission with forwards and rearwards gears, a rearwards directed video camera at the rear of the trailer, means for detecting the selection by the driver a rearwards gear so that a view from the rearwards directed video camera is presented to the driver when a rearwards gear is selected by the driver.

15. An articulated vehicle as described in any of Claims 2 to 14, in which the desired field of view is past a left (or right) rear corner of the trailer.

16. A tractor unit for towing a rearward trailer unit substantially as herein described, with reference to or as shown in Figures 6 to 21 of the accompanying drawings.

17. An articulated vehicle substantially as herein described, with reference to or as shown in Figures 6 to 21 of the accompanying drawings.

Application No: GB 9927507.5 **Examiner:** Keith Kennett
Claims searched: 1-17 **Date of search:** 7 March 2000

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B7J

Int Cl (Ed.7): B60R 1/00, 1/02

Other: Online: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	WO 95/23079 A1 (ULTRA-VIEW) see claim 1	1,2,7,9
Y	US 5530421 (MARSHALL) see column 1 lines 9-40	1,2,7,9
Y	US 5132851 (BOMAR) see Figure 10	1,2,7,9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.